

SUBURBAN NOISE CONTROL WITH PLANTINGS



A SUPPLEMENT TO "FORESTED LAND-FORMS
FOR NOISE CONTROL"

SUBURBAN NOISE CONTROL
WITH PLANTINGS

A Supplementary Report of a Study Conducted by
The University of Nebraska and the U.S. Forest Service

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EXPERIMENT STATION

SUMMARY

The potential value of trees and shrubs in reducing suburban traffic noise appears to be generally good, with certain qualifications. The degree of protection attainable is largely governed by the space available for plantings, and by the severity of the intrusion.

Noise generated by light truck and passenger car traffic may often be reduced to satisfactory levels by adding two or three rows of dense shrubs and trees between the noise source and the area to be protected. Higher level noise generated by large trucks, motorcycles, and cars with faulty exhaust systems, may not be satisfactorily controlled by plant materials alone, within the distances usually available, and additional solid barriers may be needed.

Varieties and sizes of trees and shrubs recommended for noise screening have not been included, since they were listed in the main report; however the plant materials existing at the test sites have been described.

Finally, since the study is partially complete, and further experiments are anticipated, all observations made and conclusions reached in this supplemental report should be considered tentative.

INTRODUCTION

The purpose of this study was to complete the work as planned in the research grant "Short Term Programs for Noise Abatement Using Forested Land-Forms", which was reported to the Forest Service in November, 1973 under the title "Forested Land-Forms for Noise Control".

Traffic noise data was collected, to supplement data from other sources, which had already been reported; and some work was needed to determine feasibility and techniques for a proposed comprehensive study of suburban noise control.

Three adjacent suburban sites were studied; each site contained a different kind of screen planting between an arterial street and the residence it was designed to protect.

Actual "live" sound of passing vehicles was used as the noise source, and the sound level was measured at several positions between the street and the residence. Measurements were also made at an adjacent location having no shrubs or trees in the sound path, but otherwise similar, to evaluate the effectiveness of the plantings.

Photographs, schematic drawings, and graphs showing the average sound level at each position have been included; also the reduction in sound level (attenuation) due to the presence of the screen is reported.

PROCEDURE

Test Sites

The three sites selected for study were residence properties in an upper middle class neighborhood. The back yards of the properties faced a heavily travelled arterial street, having a 35 miles per hour speed limit. Screen plantings at the sites were quite different, but the ground configurations were essentially the same. A fourth "control" site adjacent to the other three was more open, and contained a sidewalk and short grass.

Schematic drawings of the sites have been placed in the "Results of Experiments" section of the report for ease in relating sound level and microphone position. Figures 1, 2, 3 and 4 illustrate sites 101, 102, 103, 105, and the "control" area respectively.



Fig. 1 Site 101 The Walter French Jr. property, as viewed from the rear of the residence; showing the random planting of shrubs and trees between street and residence.



Fig. 2. Site 102 The W. F. Wright property, as viewed from an elevated position across the street; showing two rows of shrubs.



Fig. 3. Site 103 The Mrs. Samuel Simpson property, as viewed from across the street; showing two rows of trees.



Fig. 4. "Control" area, as viewed from a position behind the recorder; showing a sidewalk, low shrub, and sound level meter in the 15-meter position, measured from the curb.

Measurements

Sound level measurements (dBA) were made, at a distance of 5 meters from the curb, of a vehicle as it passed by the site, and again as it passed by the control area. The difference of the two levels (attenuation) was later calculated and represented the amount of reduction which could be attributed to the trees and shrubs, and to any slight ground configurations between the sites.

This procedure was repeated for twelve vehicles in each traffic lane. Then the curb-to-microphone distance was increased progressively to 10, 15, and 20 meters, and the procedure was again repeated. Near-lane and far-lane sound levels and attenuations were averaged to yield an overall evaluation for all traffic. Five complete test runs over a 3 week period were made at each site.

The decibel A-weighted scale (dBA) was used for all measurements, as being the simplest, most direct, and generally acceptable scale for the measurement of broad-band noises.

RESULTS OF EXPERIMENTS

The graphs of Figs. 5, 6 and 7 illustrate the noise reduction characteristics of the three sites. The schematic cross section drawings are positioned directly above the graphs so the microphone positions-- 5, 10, 15, and 20 meters--line up with the corresponding sound levels and attenuations.

Theoretical point source projection curves have not been shown on these graphs as they were on similar graphs of the main report, because the character of the source and the shorter distances involved did not

correspond to a point source sound projection; and to show the curves might be misleading.

Each point on a curve represents the near-lane and far-lane averages of 60 readings in each lane, i.e. 120 vehicles.

SITE 101 CROSS SECTION

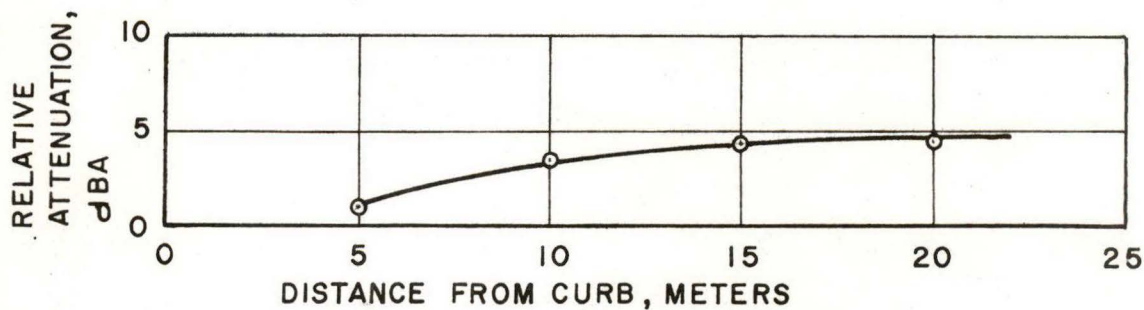
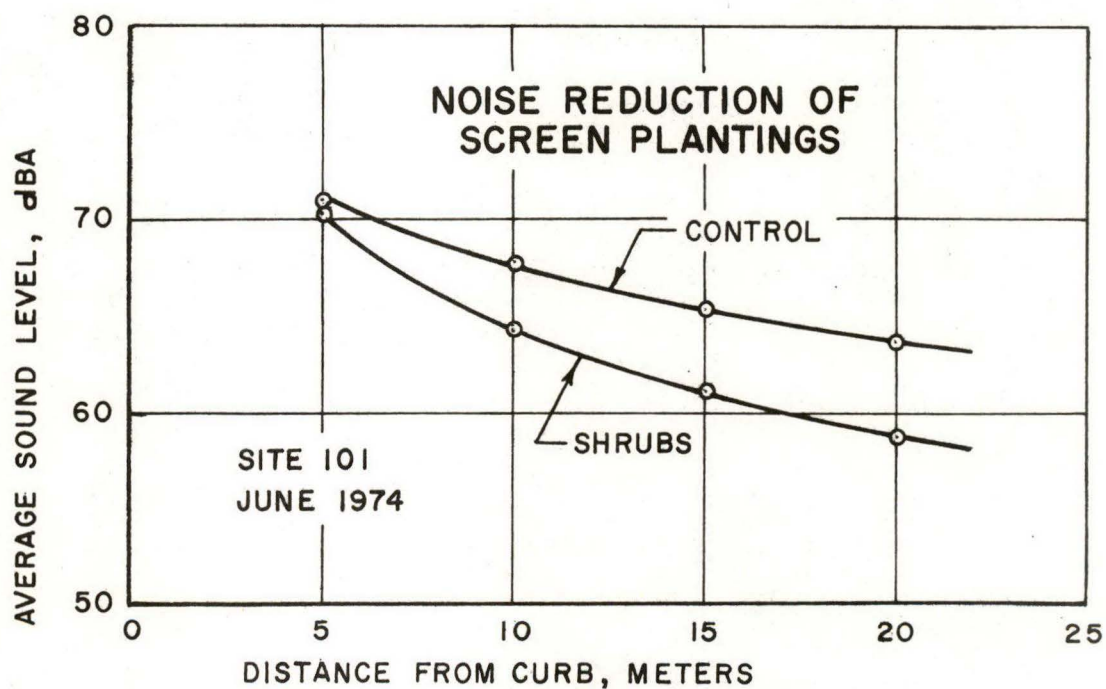
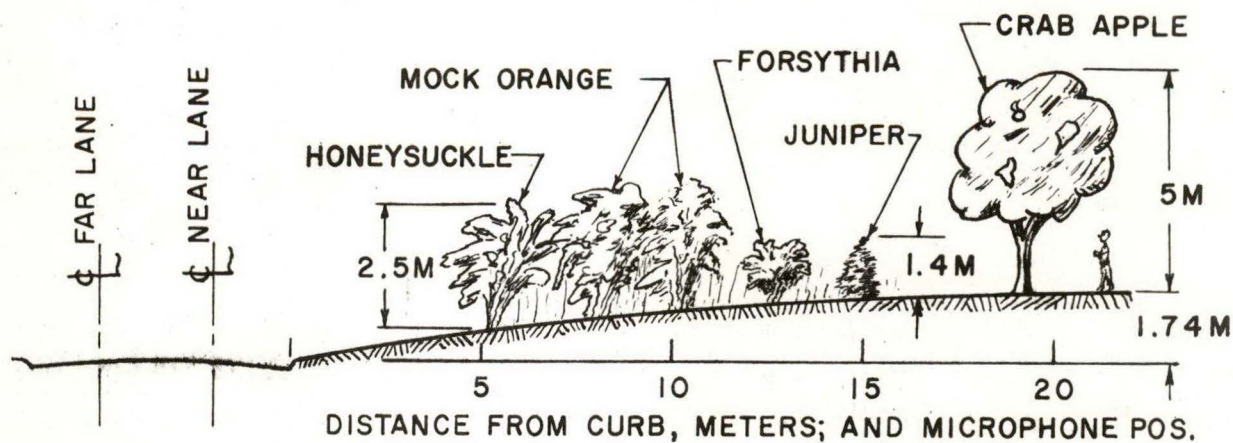


Fig. 5

SITE 102 CROSS SECTION

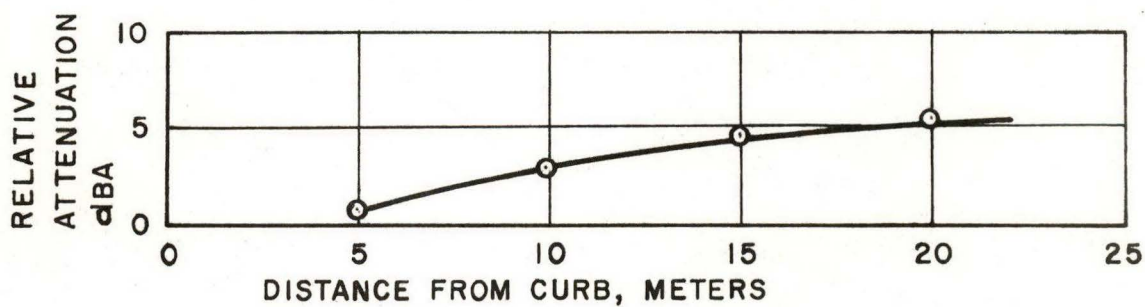
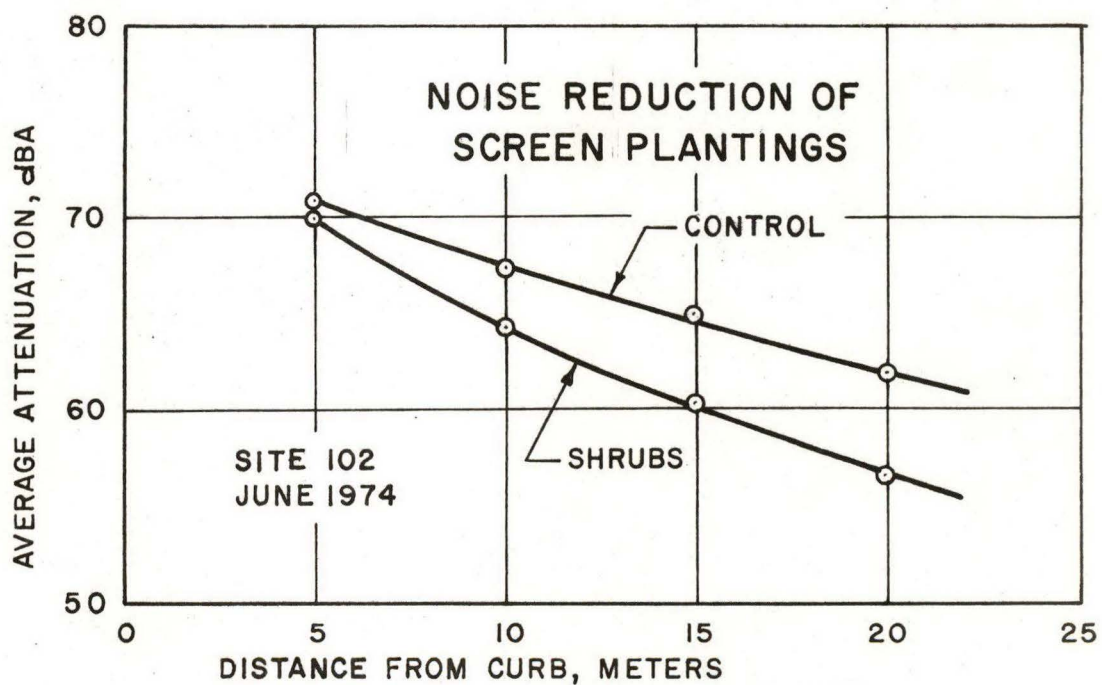
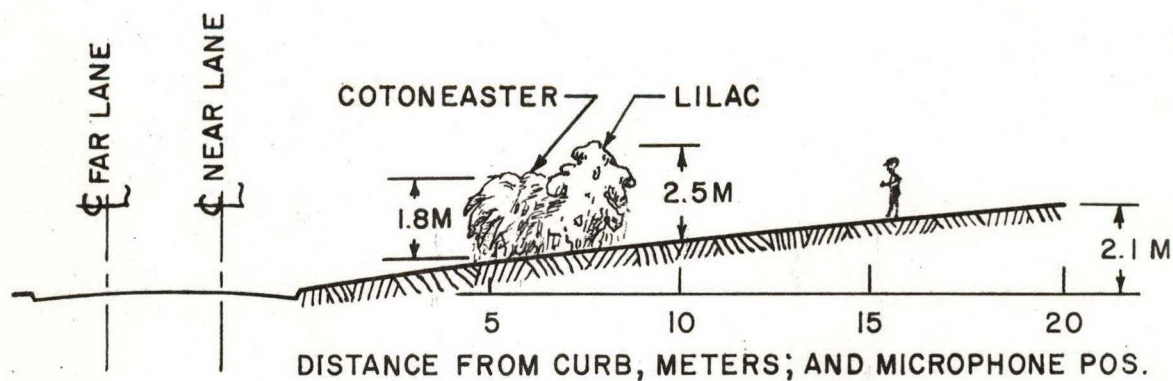


Fig. 6

SITE 103 CROSS SECTION

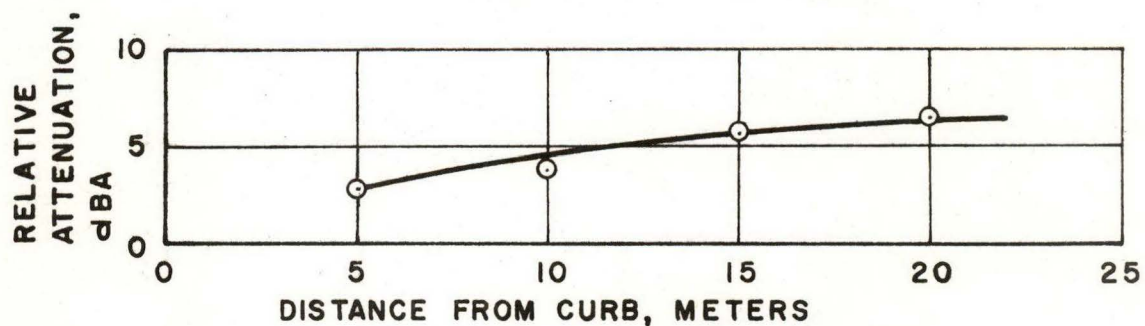
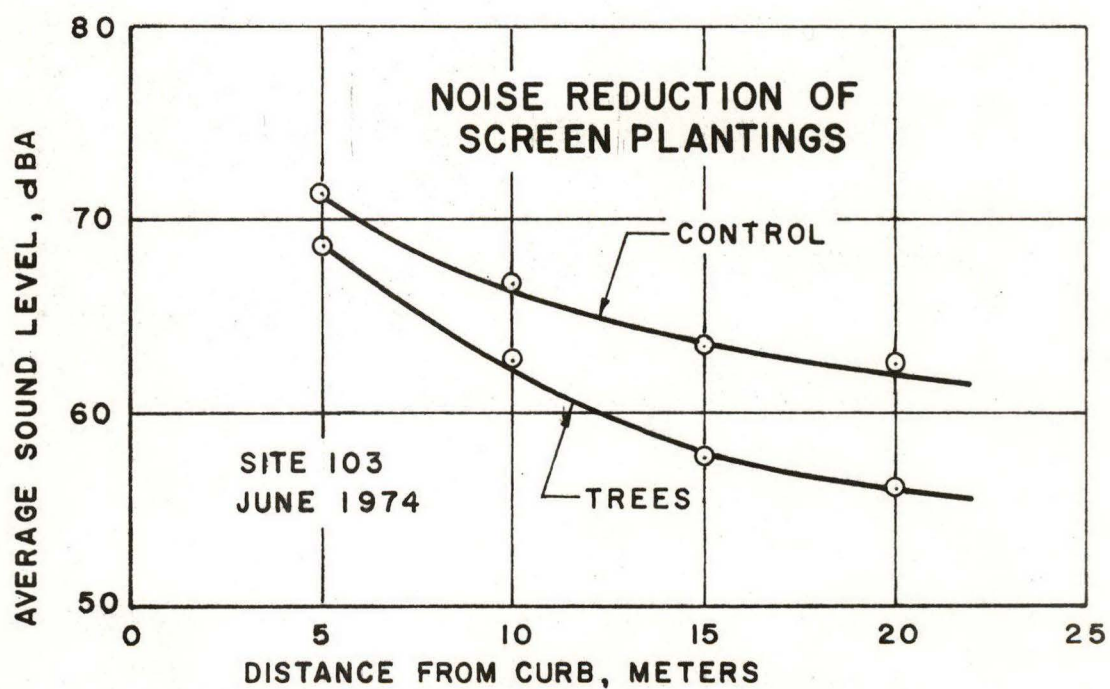
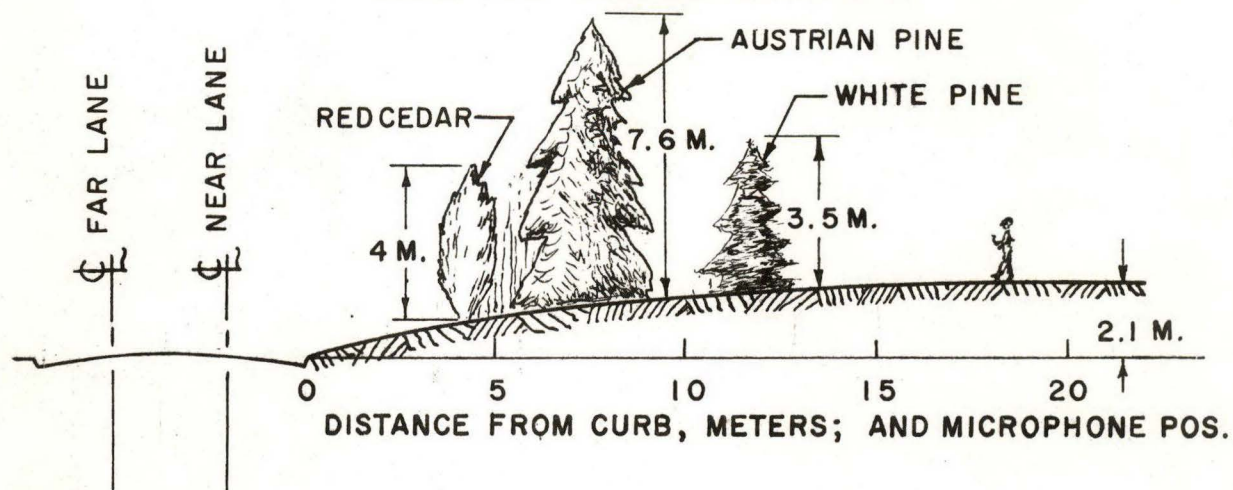


Fig. 7

OBSERVATIONS AND CONCLUSIONS

From the curves of Figures 5, 6 and 7 we observe, in all cases, that the sound level in the usable portion of the back yard area - between the house and 10 meters from the curb - is below 65 dBA. This level is considered to be generally acceptable for daytime outdoor activities, and would not interfere with ordinary conversation.

We also observe that the attenuation (sound level reduction) varies from near zero at 5 meters from the curb to about 6 1/2 decibels at 20 meters. This reduction is significant, and corresponds to about one third reduction in apparent loudness. More important, however, is the fact that this reduction occurs near the "critical 68 dBA level", where loudness changes from "disturbing" to "not disturbing" in a few decibels.

Site 101 exhibits the highest sound levels of the three sites, although only slightly higher than site 102. The attenuation at site 101 is also less than at site 103, but almost the same as at site 102.

Site 102 exhibits noise control characteristics very similar to those of site 101. The two-row planting at this site was relatively shallow, although the foliage was dense.

Site 103 exhibited the best noise control characteristics of the three. The sound level at all points of site 103 was less than at the corresponding points at the other sites, and the attenuation was greater. We note that the site 3 plantings were trees, rather than shrubs, and that the overall height and depth of the structure was greater than at the other two sites. Evidently the overall mass of the structure is of importance in noise reduction.

The control site, although not ideal for that purpose, was relatively

free of trees and shrubs which might impede the propagation of sound; also a sidewalk alongside the line of measurements could possibly have influenced the readings slightly.

Interviews with residents at the sites led to the conclusion that the traffic noise did not bother them ordinarily, but that when the leaves fell from the trees they noticed more noise inside the house.

None of the trees or shrubs had been originally planted to control noise, since this characteristic was not widely known at the time, but all residents expressed a belief that the presence of the trees and shrubs did help.

Our own observations lead us to conclude that the amount of protection afforded by the plantings at these sites is probably adequate for daytime activities, under present traffic conditions. Should the traffic become heavier, or consist of a greater portion of trucks, or should the speed limit be increased, more protection would become necessary. To improve the situation heavier plantings of trees and shrubs, especially designed for noise screening should improve the situation, and the addition of a rather low solid barrier would likely reduce the noise levels still further.

Extended studies are needed before definite conclusions can be reached and recommendations made for using plant materials to reduce suburban noise, and the conclusions offered at this stage must be considered tentative.